# NASA Facts

National Aeronautics and
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# Mars 2003 Rover

In 2003, two powerful new Mars rovers will be on their way to the Red Planet. With far greater mobility than the 1997 Mars Pathfinder rover, these robotic explorers will be able to trek up to 100 meters (about 110 yards) across the surface each Martian day. Each Mars 2003 rover will carry a sophisticated set of instruments that will allow it to search for evidence of liquid water that may have been present in the planet's past. The rovers will be identical to each other, but will land at different regions of Mars.

**Mission Overview**

Both rovers are planned for launch on Delta II rockets from Cape Canaveral, Florida, one on May 22, 2003, and the second on June 4. The first should reach Mars January 2, 2004, the other on January 20. The landing for each will resemble that of the Pathfinder spacecraft. A parachute will deploy to slow the spacecraft and airbags will inflate to cushion the landing. Upon reaching the surface, the spacecraft will bounce about a dozen times, and could roll as far as one kilometer (0.6 miles). When it stops, the airbags will deflate and retract and the petals will open up, bringing the lander to an upright position and revealing the rover.

The landed portion of the Mars Geological Rover mission features a design dramatically different from Mars Pathfinder's. Where Pathfinder had scientific instruments on both the lander and the small Sojourner rover, these larger rovers will carry all their instruments with them. Immediately after landing, the rover will begin reconnaissance of the landing site by taking a 360-degree visible color and infrared image panorama. It will then leave the petal structure behind, driving off to begin its exploration.

Using images and spectra taken daily from the rovers, scientists will command the vehicle to go to rock and soil targets of interest and evaluate their composition and their texture at microscopic scales. Initial targets may be close to the landing sites, but later targets can be far afield: These geological rovers will be able to travel almost as far in one Martian day as the Sojourner rover did over its entire lifetime.

Rocks and soils will be analyzed with a set of five instruments on each rover, and a special tool called the “RAT,” or Rock Abrasion Tool, will be used to expose fresh rock surfaces for study. Each rover has a mass of nearly 150 kilograms (about 300 pounds) and has a range of up to 100 meters (about 110 yards) per sol, or Martian day. Surface operations will last for at least 90 sols, extending to late April 2004, but could continue longer, depending on the health of the vehicles.

**Science Goals**

The mission seeks to determine history of climate and water at a two sites on Mars where condi-

tions may once have been favorable to life. The sites will be chosen by about a year before launch, on the basis of intensive study of orbital data collected by the Mars Global Surveyor spacecraft and other missions. Selection criteria will include clear evidence of ancient water, as indicated either by minerals that form under wet conditions or landscapes apparently shaped by water. Possibilities include former lakebeds or hydrothermal deposits. The rovers' instruments will be used to read the geologic record at the sites, and to evaluate how suitable the past conditions would have been for life.

**Science Instruments**

Each rover will carry five scientific instruments and an abrasion tool: a Panoramic Camera provided by NASA's Jet Propulsion Laboratory, Pasadena, Calif.; a Miniature Thermal Emission Spectrometer from Arizona State University, Tempe, Ariz.; a Mössbauer Spectrometer from the Johannes Gutenberg University, Mainz, Germany; an Alpha-Proton X-ray Spectrometer from Max Planck Institute for Chemistry, also in Mainz, Germany; and a Microscopic Imager from JPL. The Rock Abrasion Tool provided by Honeybee Robotics, New York, N.Y., will grind away the outer surfaces of rocks, which may be dusty and weathered, allowing the science instruments to determine the nature of rock interiors. The payload also includes magnetic targets provided by Niels Bohr Institute in Copenhagen, Denmark. The spectrometers, microscopic imager and abrasion tool will be deployed on a robotic arm.

• ***Panoramic Camera: Providing the Geologic Context.***

This instrument will be used to reveal the terrain around the rover, searching for evidence of the action of liquid water. It will be used to help select the most promising rock and soil targets for more intensive study, and to pick new regions for the rover to explore. Its resolution is over three times better than that of the cameras carried on the Mars Pathfinder lander.

• ***Miniature Thermal Emission Spectrometer: Identifying Minerals at the Site***.

This instrument will view the scene around the rover in the infrared, determining types and abundance of many different kinds of minerals. A particular goal will be to search for distinctive minerals that are formed by the action of water. Scanning to build up a panoramic image, it will also be used in tandem with the Panoramic Camera to select science targets and to pick new areas to explore.

• ***Mössbauer Spectrometer: Identifying Iron-Bearing Minerals.***

This instrument will be placed against rock and soil targets by an arm on the rover. It will identify any minerals that contain iron, help to evaluate what role water played in the formation of these minerals, and help to discern the extent to which rocks have been weathered.

• ***Alpha Proton X-Ray Spectrometer: Determining the Composition of Rocks***.

This instrument is an improved version of the instrument used by Pathfinder's Sojourner rover. It measures the concentrations of most major elements, allowing investigation of how rocks and soils formed and how they have been altered over time.

• ***The Microscopic Imager: Looking at Fine-scale Features***.

This instrument will reveal fine-scale appearance of rocks and soils, which can provide essential clues to how those rocks and soils were formed. For instance, the size and angularity of grains in water-lain sediments can reveal how they were transported and deposited.

**Project/Program Management**

The Mars Geological Rover is managed for NASA by the Jet Propulsion Laboratory, a division of the California Institute of Technology, Pasadena, Calif. At NASA Headquarters, David Lavery is the program executive and Dr. Catherine Weitz is the program scientist. At JPL, Peter Theisinger is the project manager and Dr. Joy Crisp is the project scientist. The principal investigator for the science payload is Dr. Steve Squyres from Cornell University, Ithaca, N.Y

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